

Impacts of habitat loss, climate change and pesticide exposure on kit fox populations

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Background / Question / Methods

The San Joaquin kit fox is an endangered sub-species in decline due primarily to loss of habitat. This small, desert-adapted fox was once widely distributed across the floor of the southern San Joaquin Valley, but agriculture and development have replaced much of the species' habitat. In addition to pressure from continued habitat loss, the kit fox faces pressure from climate change. High precipitation in habitats now dominated by non-native, annual grasses leads to dense, tall growth that is unsuitable for both the kit fox and its primary prey, kangaroo rats. Conversely, persistent dry conditions lead to low primary productivity that cannot support kangaroo rats, and results in a corresponding decline in kit fox populations. Finally, kit foxes using human-dominated landscapes are exposed to anticoagulant rodenticides, which have adverse effects in individuals but unknown effects on fox populations.

Results / Conclusions

We modeled the cumulative impact of land-use change, climate change, and hypothetical rodenticide exposure scenarios on kit fox populations using HexSim, a new life history simulator that is particularly well-suited for investigating stressor interactions. Our study indicates that land-use change will likely create larger impacts than pesticide exposure, and climate effects will depend in part on uncertain precipitation projections. Our study illustrates how recent advances in individual-based population modeling have made it possible to study off-target pesticide impacts while explicitly addressing real-world complexities such as habitat fragmentation, climate change, and species interactions.